cm). In these systems quantum interference is very important, since at low enough temperatures (< 1K) the phase coherence length of quasiparticles ("electrons") exceeds the size of the system. This means that the electrons preserve their "individuality" when passing through the system.

Since the wave function of the quantum particle depends on its energy as $e^{-iEt/}$, any inelastic interaction spoils the phase coherence. Then the condition

$$l_\varphi \quad l_i < L \qquad \text{[sic]} \qquad (1.53)$$

must hold. Here l_φ is the phase coherence length, l_i is the inelastic scattering length, L is the size of the system. The above condition can be satisfied in experiment, due to the fact we have discussed above: that in the condensed matter we can deal with weakly interacting quasiparticles instead of strongly interacting real particles.

Because the inelastic scattering length of the quasielectron exceeds the size of the mesoscopic system, we can regard it as a single particle in the external potential field and apply to it the path integral formalism in the simplest possible version.

ALEXANDER M. ZAGOSKIN, QUANTUM THEORY OF MANY-BODY SYSTEMS p. 19-20 (Springer 1998), citing Y. Imry, "Physics of Mesoscopic Systems," in DIRECTIONS IN CONDENSED MATTER PHYSICS: MEMORIAL VOLUME IN HONOR OF SHANG-KENG MA (ed. G. Grinstein, G. Mazenko, World Scientific 1986).

On page 15, between lines 16 and 17, please place the following paragraph:

Joyez *et al.*, Observation of Parity-Induced Suppression of Josephson Tunneling in the Superconducting Single Electron Transistor, *Phys. Rev. Lett.* 72, pp. 2458-2461, provide a complete description of the operation of a superconducting single electron transistor (SET). Joyez *et al.* states that:

> The consequences of the duality of phase and number-of-particle variables are particularly well illustrated by the competition between Josephson tunneling and single electron charging phenomena in ultrasmall superconducting junction systems. One of the simplest devices consists of two Josephson junctions in series: The number of Cooper pairs on the middle "island" tends to be fixed by the charging energy $E_c=e^2/2C$ of the island while the associated phase tends to be fixed by the Josephson coupling energy E_J of the two junctions which we suppose identical for simplicity. Here C refers to the total capacitance of the island. This model system has been investigated

> theoretically in detail. For large area junctions ($E_J >> E_C$) the charging effects are overcome by Josephson tunneling and the maximum supercurrent that can flow through the two junction system is just $I_o=2eE_J/$, the maximum supercurrent of each junction. However, for small area junctions ($E_J << E_C$), the maximum supercurrent should strongly depend on the polarization charge Q_g applied to the island by means of a gate electrode, hence the name of "superconducting single electron transistor" given to such a device.

(Joyez *et al.*, p. 2458). Further, Joyez *et al.* describe fabrication of a SET:

> The sample was prepared using standard e-beam lithography and shadow mask evaporation techniques. The main difference with previous experiments is the use of the three-angle evaporation technique of Haviland *et al.*, J. Phys. B 85, 339 (1991) in order to fabricate in a single pump down the alumina-covered Al island electrode, the two Al drain and source electrodes, and the Cu (3 wt.% Al) buffer electrodes.

(Joyez *et al.*, p. 2458) (citation added). With regard to Parity Keys, ZAGOSKIN, p. 206, describes the parity effect in the following passage:

> If the grain becomes superconducting, there appear interesting new possibilities. As we know, in the ground state of a superconductor all electrons are bound in Cooper pairs (and therefore the ground state can contain only an even number of electrons). Any odd electron will thus occupy an excited state, as a bogolon, and its minimum energy, measured from the ground state energy, will be Δ.
>
> This is the parity effect in superconductivity. Of course, in a bulk superconductor it is of no importance, but not so in our small system, where charging effects enter the game.

<u>IN THE CLAIMS</u>:

Marked up versions of all revised claims, showing insertions and deletions, are included in Appendix B. A clean version of the pending claims is included in Appendix C.

Rewrite claim 39 as follows:

39. (Amended) A quantum register, comprising:

a first bank of superconducting material;

at least one mesoscopic island of a superconducting material; and